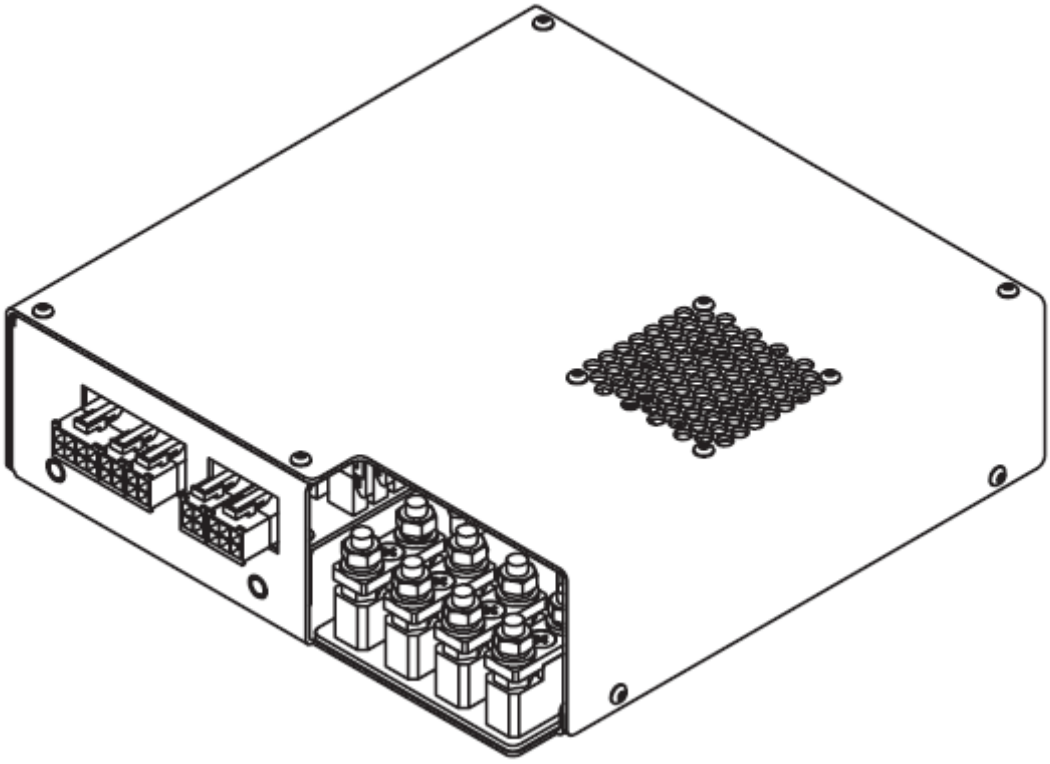
NBU-1012 Discharge circuit

User Manual



Overview / Applications

NBU-1012 discharge circuit is designed for simplification of solid-state laser systems development. Module forms flashlamp pulses of quasi-rectangular shape using the energy stored in external capacitors bank. Special feature of the driver is built-in simmer module with complete triggering circuit for serial or external flashlamp triggering.

NBU-1012 is intended for capacitor charging / pulse discharging applications such as pulsed laser systems.

By default NBU-1012 is supplied in modification for serial triggering. Modification for external triggering is available on request (see *Part number* section).

Cooling

Module is cooled with embedded fan.
No external cooling is required.

Connections, signals, signal descriptions

CAPACITORS: M6 studs

C+ capacitor battery positive contact
C– capacitor battery negative contact

FLASHLAMP: M6 studs

LAMP+ positive flashlamp contact (anode)
LAMP– negative flashlamp contact (cathode)

CM (TO CAPACITOR CHARGING MODULE): Molex 39-30-1060

PIN (color)	DESIGNATION	DESCRIPTION
1, 2, 3 (red)	**Positive CM**	Positive contact connection from charging module
4, 5, 6 (black or blue)	**Negative CM**	Negative contact connection from charging module

+24 VDC (TO +24V POWER SUPPLY MODULE): Molex 39-30-1040

PIN (color)	DESIGNATION	DESCRIPTION
1, 2 (yellow)	**+24V DC**	Connect to these pins positive wire of 24V DC power supply for correct operations of NBU-1012 Regulation: 17 ÷ 31V DC. Maximum input current: 4A
3, 4 (green)	**+24V DC Return**	Return from power supply producing +24V DC

EXT (TO EXTERNAL TRIGGERING TRANSFORMER): Molex 39-30-1040

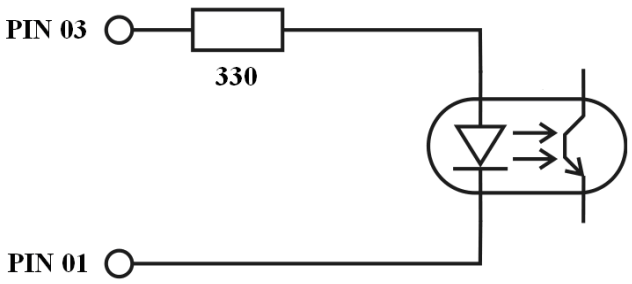
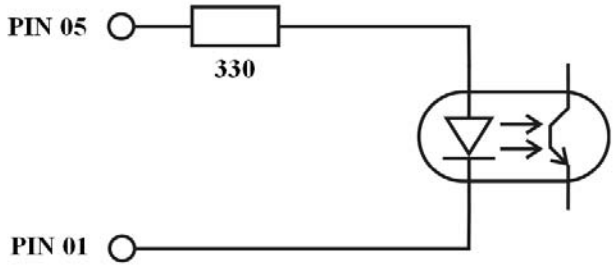
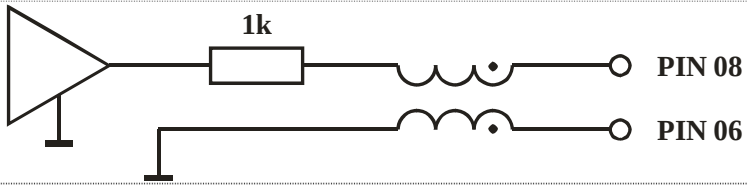
PIN (color)	DESIGNATION	DESCRIPTION
1, 2	**Not Connected**	
3	**Positive EXT**	Positive of triggering transformer primary winding
4	**Negative EXT**	Negative of triggering transformer primary winding

This EXT connector is actual for NBU-1012-EXT (external triggering modification) only. In standard NBU-1012 this connector may be absent or non-functional.

PWF (PULSE CONTROL): Molex 39-30-1080

PIN (color)	DESIGNATION	DESCRIPTION
1 (black)	**Interface Return**	Return *Pulse* and *Discharge* signals
2, 4, 7	**Not Connected**	–
3 (orange)	**Pulse**	Duration of +5V DC pulse at *PIN3* completely defines IGBT-key open state time and, as consequence, flashlamp pulse duration
5 (green)	**Discharge**	While 0V voltage is applied to *PIN5* (or *PIN5* is unconnected), i.e. while *Discharge* is *ON*, capacitor battery is continuously discharging on internal 1kOhm 50W resistor. While *Discharge* is *ON* capacitor charging power supply is blocked and capacitor charging is prohibited. While +5V DC voltage is applied to *PIN5* (*Discharge* is *OFF*) module can be operated in the regular way.
6 (blue)	**Monitor Return**	Return *Voltage Monitor* signal
8 (red)	**Voltage Monitor**	Voltage measured at *PIN8* is a monitor signal proportional to voltage on capacitor battery 0V at *PIN8* corresponds to 0V on capacitor battery; 10V at *PIN8* corresponds to maximal voltage value (1000V by default) on capacitor battery

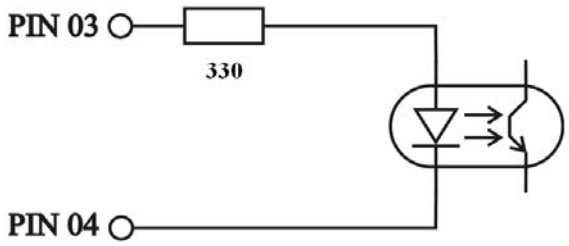
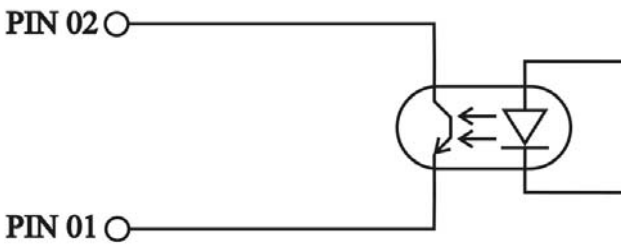
PWF CIRCUITS:

PWF: Pulse	
PWF: Discharge	
PWF: Voltage Monitor	

SIM (SIMMER SUPPLY CONTROL): Molex 39-30-1040

PIN (color)	DESIGNATION	DESCRIPTION
1 (violet)	**Sensor Return**	Return *Simmer Sensor* signal
2 (yellow)	**Simmer Sensor**	*Simmer Sensor* circuit is closed while simmer current flows through flashlamp and is open while simmer current is absent
3 (red)	**Enable**	Since +5V DC voltage is applied to *PIN3* embedded simmer supply tries to strike and maintain low-current discharge (simmer) in the flashlamp. If flashlamp triggering is failed simmer supply module tries to trigger it again with up to 30 Hz repetition rate. After successful triggering the simmer supply can support up to 800mA flashlamp current (500mA is preset by default). Simmer will be maintained until 0V is applied to *PIN3*.
4 (black)	**Enable Return**	Return *Simmer Enable* signal

SIM CIRCUITS:

SIM: Enable	
SIM: Simmer Sensor	

Safety

Warning! This equipment produces high voltages that can be very dangerous. Don't be careless around this equipment.

- During operation the protective covers of the equipment must be securely in place and all electrical connections must be properly attached
- NBU-1012 discharge circuit is designed to be installed inside a properly grounded metal. It is the user's responsibility to ensure that personnel are prevented from accidentally contacting the NBU-1012, especially the CM Positive/Negative, C+/–, LAMP+/– connectors and cable. **Casual contact could be fatal!**
- After shutdown, do not handle the capacitance load until it has been discharged. Use an appropriate meter to check for complete discharge.
- Disconnect the module from the DC power source before making or changing electrical or mechanical connections.
- **Don't remove protective covers!** There are no user serviceable parts inside this equipment.

Operations

1. Connect capacitor charging power supply, +24V DC power supply, capacitor battery and flashlamp to NBU-1012 module
2. Set +5V DC voltage on *PIN5* of *PWF* to switch off capacitor bank discharging

Warning! By default capacitor discharging is on.
Be careful and always switch off capacitor discharging before turning on your capacitor charging module.
Otherwise it may lead to capacitor charging module failure caused with open-circuit operations

3. *Disable* simmer supply (*PIN3* of *SIM*)
4. Apply *+24V DC* power to the module
5. *Enable* your capacitor charging power supply (charging module).

As soon as charging module starts operation, capacitors are charged

6. *Enable* simmer supply (set +5V DC on *PIN3* of *SIM*)
7. Wait 5-10 seconds for *Simmer Sensor*. If it fails shut down your system
8. *Disable* your capacitor charging power supply before pulse

Note that PCP and PCA-series power supplies are well-protected and it isn't obligatory to disable them. We recommend you to not disable PCP (PCA) at high on-off time ratio

9. Set +5V DC pulse on *PIN3* of *PWF*. This pulse duration defines IGBT-key open state time and flashlamp pulse width.
10. *Enable* your power supply after pulse
11. Repeat #8-#10

To power down NBU-1012 and discharge capacitor battery

1. *Turn off* or *Disable* your capacitor charging power supply (**important!**)
2. *Disable* simmer supply
3. Set 0V on *PIN5* of *PWF* to switch on capacitor bank discharging. Wait for complete discharge of capacitors.

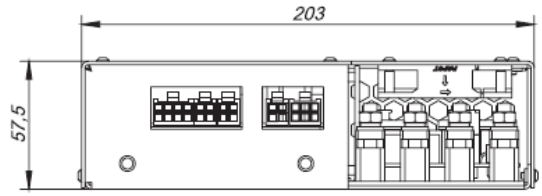
Warning! Don't use complete discharge of capacitor battery too often because of discharging resistor overheating

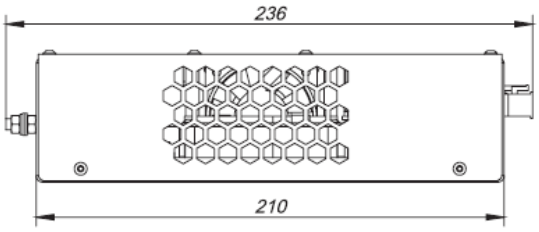
4. Remove *+24V DC* power from the module.

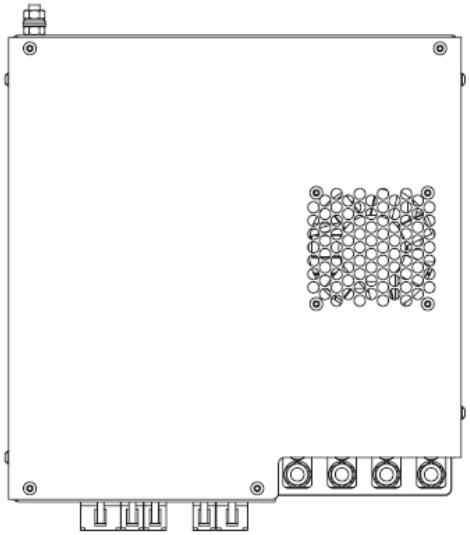
Specification

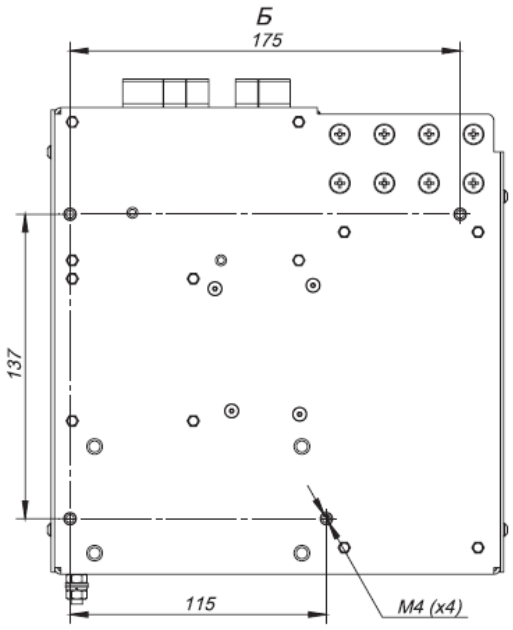
+24VDC:	
Voltage regulations	+24 V DC
Maximal power consumption	4 A (max)
PULSE PARAMETERS:	
Max. voltage	1000 V
Max. discharge current (depends on flashlamp impedance K0)	1000 A for pulse width < 1 ms 500 A for pulse width > 1 ms
Max. average power	3000 W
Min. pulse width	50 us *(other on request)*
Max. pulse width	10 ms *(other on request)*
Max. rep. rate	50 Hz *(up to 200Hz on request)*
RECOMMENDED WIRES:	
For capacitor bank connections	LIFY 4 sq mm (min)
For flashlamp connections	LIFY 4 sq mm (min)
SIMMER PARAMETERS	
Simmer current	500 mA (*300-800 mA on request*)
Max output voltage	200 V (*300 V on request*)
Max output power	70 W (*100 on request*)
Open circuit voltage	1500 V
FLASHLAMP TRIGGERING PARAMETERS	
Voltage	~ 10 kV negative pulse (NBU-1012) ~ 1 kV negative pulse (NBU-1012-EXT)
Pulse width	~1 us
Restrike rate	1-30 Hz (automatically adjusted)
Cooling	No external cooling is required
Protections	
From simultaneous capacitor battery charging and discharging (see *Discharge* signal description)	
From too short pulses (50us by default, other by request)	
From too long pulses (10ms by default, other by request)	
Environment:	
Operation temperature	-20 … +45 °C
Storage temperature	-40 … +85 °C
Humidity	90%, non-condensing
Size (LxWxH)	210x203x58 mm
Weight	3.0 kg

DRAWINGS









Part number table

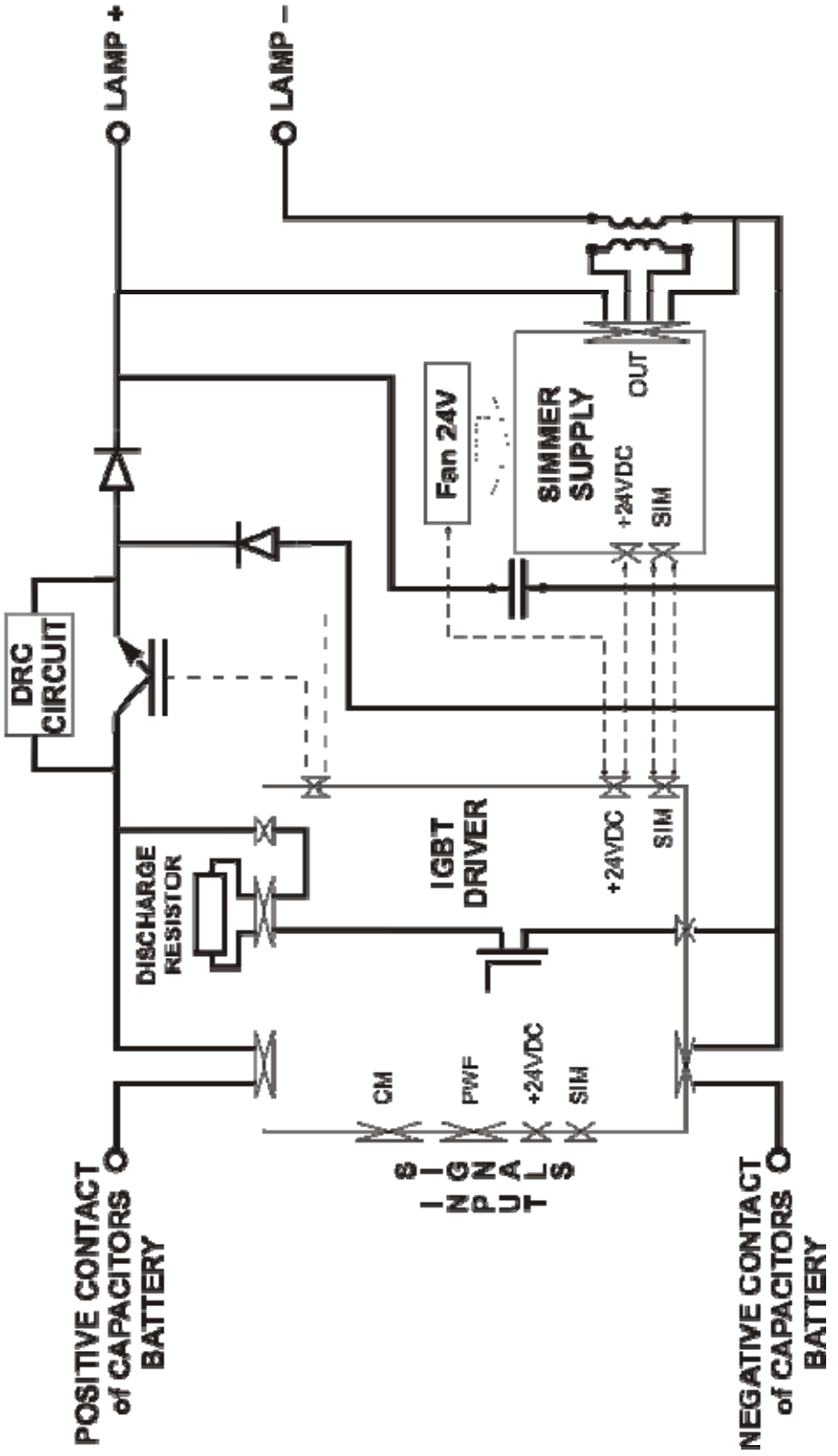
Part Number	Triggering
NBU-1012	Serial
NBU-1012-EXT	External

Example: NBU-1012-EXT

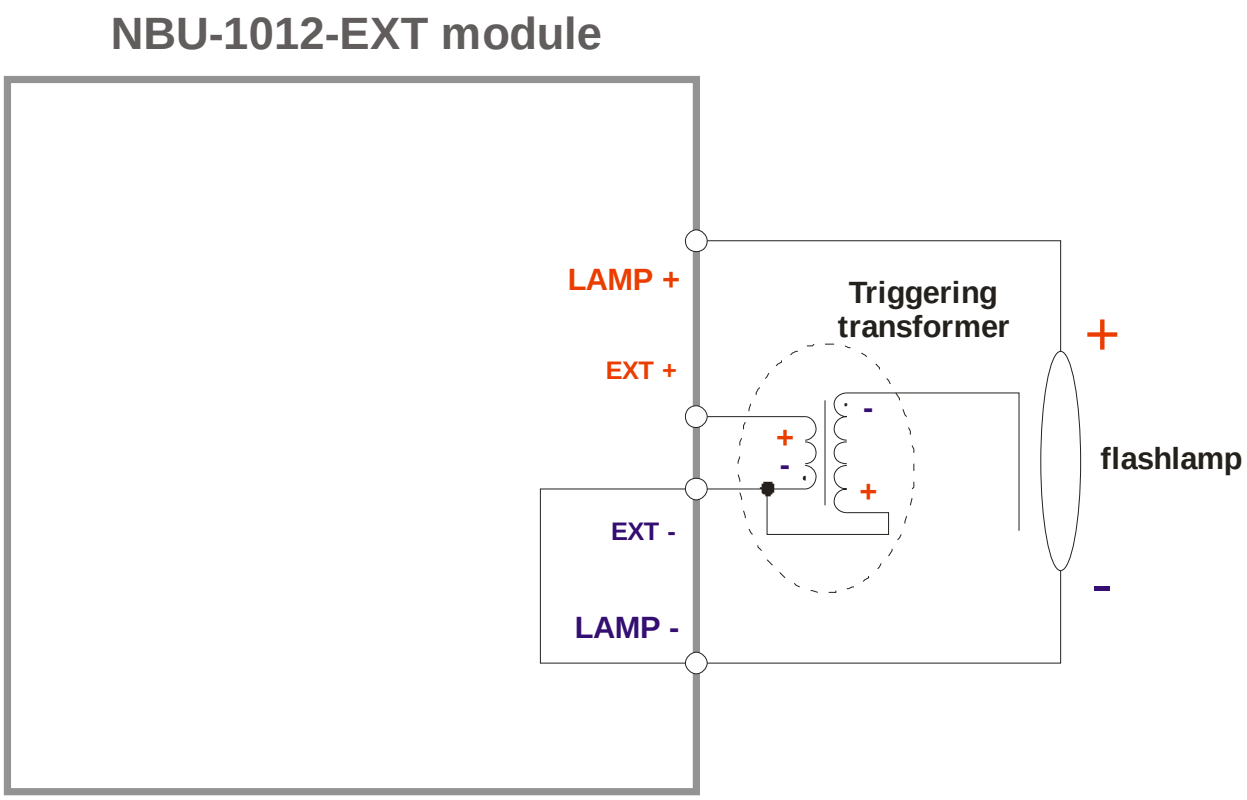
Options available on request:

- non-standard simmer current
- non-standard simmer voltage
- non-standard simmer power
- other minimal pulse width protection
- other maximal pulse width protection
- extended repetition rate range

System flowchart (Serial triggering modification)



System flowchart (External triggering modification)



With external triggering modification **NBU-1012-EXT** we supply triggering transformer as it shown at drawing. Of course you may use any other construction of triggering transformer.